CLAIMS

1. A method for programming a pattern matching engine having a plurality of information storage entries with one or more regular expressions, each regular expression including a plurality of characters and having a corresponding action to be applied to matching strings, the method comprising the steps of:

identifying one or more borders within a given regular expression, the one or more borders separating the given regular expression into a plurality of sub-expressions, at least one sub-expression having a plurality of sequential characters; and

loading one or more entries of the pattern matching engine with a plurality of the sequential characters from at least one sub-expression, wherein

the borders are defined by a predetermined sequence of regular expression metacharacters.

2. The method of claim 1 wherein the predetermined sequence of regular expression metacharacters are a wildcard metacharacter followed immediately by a repeat last character zero, one or more times metacharacter.

3. The method of claim 1 further comprising the step of organizing at least part of the pattern matching engine into a plurality of sections, and wherein each section of the pattern matching engine is loaded with a plurality of search patterns for a corresponding sub-expression.

4. The method of claim 3 wherein the entries of a given section are loaded with one of a search pattern that includes a complete match of the respective sub-expression, a search pattern that includes a partial match of the respective sub-expression, and a mismatch pattern.

5. The method of claim 4 further comprising the steps of:
associating at least one sub-expression with a current state variable; and

3   loading the associated current state variable into each entry of the section of the

4   pattern matching engine that contains the at least one sub-expression.

1   6. The method of claim 5 wherein the pattern matching engine has at least one

2   content addressable memory (CAM) loaded with the one or more regular expressions.

1   7. The method of claim 6 wherein

2   the CAM is a ternary content addressable memory (TCAM) that supports don't

3   care values, and

4   the mismatch pattern includes all don't care values.

1   8. The method of claim 7 wherein

2   each regular expression is associated with an action,

3   the pattern matching engine further includes a second memory device having a

4   plurality of entries, and

5   the entries of the second memory device are loaded with the actions associated

6   with the one or more regular expression.

1   9. The method of claim 8 wherein each entry of the TCAM identifies a corre-

2   sponding entry of the second memory device.

1   10. The method of claim 9 wherein at least one TCAM entry is associated with a

2   next state variable, the method further comprising the step of loading the entry of the sec-

3   ond memory device that is identified by the at least one TCAM entry with the associated

4   next state variable.

1   11. The method of claim 10 wherein

2   the at least one TCAM entry is located in a TCAM section whose entries are as-

3   sociated with a current state variable having a first value, and

4   the next state variable has a second value that differs from the first value, thereby

5   specifying a new TCAM section to be searched.

1   12. The method of claim 11 wherein each TCAM entry has a match cell that con-

2 tains the complete match, the partial match or the mismatch pattern.

1   13. A pattern matching engine for use in searching network messages for a pre-

2 defined regular expression and for determining matches thereto, the pattern matching en-

3 gine comprising:

4   a regular expression storage device for storing the pre-defined regular expression

5 and one or more corresponding actions that are to be applied to network messages

6 matching the respective regular expression, the storage device including a content-

7 addressable memory (CAM) having a plurality of entries containing at least the pre-

8 defined regular expressions; and

9   a decoder circuit coupled to the regular expression storage device, the decoder

10 circuit configured to control an input to the CAM that includes a given network message

11 or selected portion thereof for comparison with the regular expressions contained within

12 the CAM, and to receive and decode an output returned from the regular expression stor-

13 age device, the output identifying the action to be applied to the given network message

14 or portion thereof,

15   whereby the CAM is configured such that multiple sequential characters from a

16 subject network message are compared against all CAM entries in parallel.

1   14. The pattern matching engine of claim 13 wherein the CAM is configured to

2 search 32 sequential characters of the subject network message in parallel.

1   15. The pattern matching engine of claim 13 wherein the CAM is configured to

2 skip an indeterminate, contiguous number of a given character occurring in the subject

3 network message.

1   16. The pattern matching engine of claim 13 wherein the CAM is configured to

2 skip an indeterminate number of a plurality of predefined characters occurring contigu-

3 ously in the subject network message.

17. The pattern matching engine of claim 13 wherein

the regular expression is separable into a plurality of sub-expressions, at least one

sub-expression having a plurality of sequential characters, and

at least some of the CAM entries are loaded with sequential characters of the at

least one sub-expression.

18. The pattern matching engine of claim 17 wherein the sub-expressions are

separated by respective borders defined by a predetermined sequence of regular expres-

sion metacharacters.

19. The pattern matching engine of claim 18 wherein the predetermined sequence

of regular expression metacharacters are a wildcard metacharacter followed immediately

by a repeat last character zero, one or more times metacharacter.

20. The pattern matching engine of claim 19 wherein

the CAM is organized into a plurality of sections, and

the entries of each CAM section include a plurality of search patterns for a corre-

sponding sub-expression of the regular expression.